SatNav News

GNSS TestBed

The role of a TestBed is to support the operational implementation of a GNSS by:

✓ Performing independent analyses and validation of SBAS software and hardware
✓ Supporting ground and flight testing required for development of ICAO operational standards, procedures, and user avionics equipment
✓ Demonstrating GBAS and SBAS approaches and performance in real time
✓ Supporting international connectivity and the transition to a seamless Global Navigation Satellite System
✓ Collecting, archiving, and distributing data to the user and research community for pre-planned product improvements
✓ Assessing the hardware, infrastructure, and cost requirements necessary to meet national aviation needs.

GNSS Takes Off in Asia

By Jennifer Campbell, GPS TAC (AND-730)

Representatives from the Asia Pacific Economic Cooperation (APEC), the FAA Office of International Research and Acquisition (ASD-500), the FAA Wide Area Augmentation System Product Team (AND-730), and the FAA Navigation Systems Implementation Product Team (AND-720) presented the Global Navigation Satellite System (GNSS) TestBed Concept and Implementation in four cities across Asia from August 27 to September 8, 2001. Approximately 150 attendees from the APEC Satellite Navigation and Communication (SN&C) Systems Advisory Committee and their technical and political experts attended one of the four meetings hosted by Japan, Hong Kong, the Philippines, and Thailand.

The meetings focused on the implementation of a GNSS Southeast Asia TestBed capability to promote research and to launch the implementation of GNSS technology in the region. The meeting topics included the detailed steps necessary to successfully transition from current ground-based navigation systems to a satellite-based navigation system. These meetings were a part of the FAA's continuing interna-

In this issue:

tional cooperative effort and commitment to provide information and technical assistance with the implementation of satellite-based navigation technologies to countries and regions worldwide.

Navigation Workshop
By Carol Wheeler, ANN TAC (AND-700)

The following article was written in anticipation of the FAA Navigation Workshop. Please look for an update in the next edition of the SatNav News.

2001

FAA Navigation Outreach Workshop

The FAA Navigation Integrated Product Team (IPT), AND-700, is conducting a National Navigation Workshop in San Antonio, TX from September 11-13 of this year. The National Workshop provides the opportunity for the FAA navigation community to meet, learn, and discuss current issues affecting the management of navigation aids (NAVAIDS), and the recently released FAA Operational Evolution Plan (OEP).

The June 6th release of the OEP will have an impact on the decisions and plans for managing NAVAIDS. The OEP, in brief, is a ten-year plan designed to reduce airline delays by increasing commercial airline traffic by 30%. This goal will be met by expanding the airspace around airports, and by adding new equipment in aircraft.

Navigation issues to be discussed in the framework of the OEP include sustainment of the current infrastructure and the transition from ground-based to satellite-based NAVAIDS.

In preparation for the workshop, the Navigation IPT management team visited each of the nine FAA regional offices and two centers during a whirlwind six-week schedule. The visits included a two-hour briefing on the current state of NAVAIDS in the morning, then a question and answer session in the afternoon. The issues discussed were recorded

and sent to the regions and centers for their review and approval. These final minutes are being used to shape the specific agenda items for discussion and instruction at the National Workshop.

Workshop participants will find a busy agenda upon their arrival. During the first day, all participants will attend a general session. They will hear from experts in their field on the "State of Navigation", "OEP-Future of Navigation", "Challenges today and in the year 2010", and more. During the second day, the workshop will offer four breakout groups to discuss specific issues gathered from the visits to the regions and centers. During the third and final day, the breakout groups will meet for a half-day session to prepare a report on the conclusions reached or actions to be followed up by the teams. The entire group will reconvene in the afternoon to hear what conclusions and actions each group reports and to discuss and agree on them as a community.

Registration for the workshop is underway and currently includes participants from each of the AND-700 Navigation Product Teams--Systems Engineering, Local Area Augmentation System, Navigation Systems Implementation, Wide Area Augmentation System, and Navigation and Landing Systems Acquisition. Regional representatives have registered from the ANI Engineering Center, Airway Facilities Operations Branch, Air Traffic and Flight Standards Divisions. The Mike Monroney Aeronautical Center representatives include the Logistics Center, Flight Inspection, and the Operations Branch. Key Headquarters Organizations include Requirements, NAS Operations, Airway Facilities Service, Resource Management, and more. The Engineering and Test Division located at the William J. Hughes Technical Center has also registered for participation.

The Navigation IPT is confident that the workshop will benefit each participant for the time invested by providing a broad perspective on the tasks to be accomplished through the diversity of the representatives. The workshop aims to provide an opportunity for the navigation community to improve communication and understanding through interaction. The enthusiastic response to this workshop shows evidence that the community is eager to work together to enhance its effectiveness.

ICAO GNSS Panel Update

By Tom Meyer, GPS TAC/NAS Implementation Team (AND-720)

ICAO's Global Navigation Satellite System Panel (GNSSP) Working Group A held a week long meeting in Philadelphia, PA from April 22–27, 2001. Twenty-seven operational and technical experts from 14 countries participated in the meeting. Recommendations from this meeting were to be drafted into version 5 of the manual at the author's group meeting in Montreal on August 27, 2001.

The highlight of this meeting was the drafting of recommended inputs to update ICAO's Global Air Navigation Plan for CNS/ATM Systems, in preparation for the upcoming meeting of intersted states in Rio de Janeiro this fall. Version 4 of the draft GNSS Manual, set to replace ICAO Circular 267, was reviewed to capture recently recommended updates to ICAO Standards and Recommend Practices (SARPS) that will become effective in November 2001. Other areas of discussion included issues relating to the use of the Ground Based Augmentation System Differential Position Service (GBAS/P or GDPS) and Satellite Based Augmentation System (SBAS) NOTAM and Status Monitoring issues related to PANS RAC Phraseologies, PANS-ABC, and Annex 15 requirements.

Technical and operational experts from the US, Germany, and Canada were chosen to participate in international sub working group activities that will provide updates to the navigation and air traffic management sections of the Global Plan continuing to convey ICAO's vision for GNSS.

LAAS Availability

by Navin G. Mathur, GPS TAC (AND-710)

Random House Dictionary defines availability as "suitable or ready to use". Availability for a system such as LAAS is defined in terms of how long the system can provide suitable service without interruptions. In other words, it is the amount of time the system provides required accuracy, integrity, and continuity in the coverage volume.
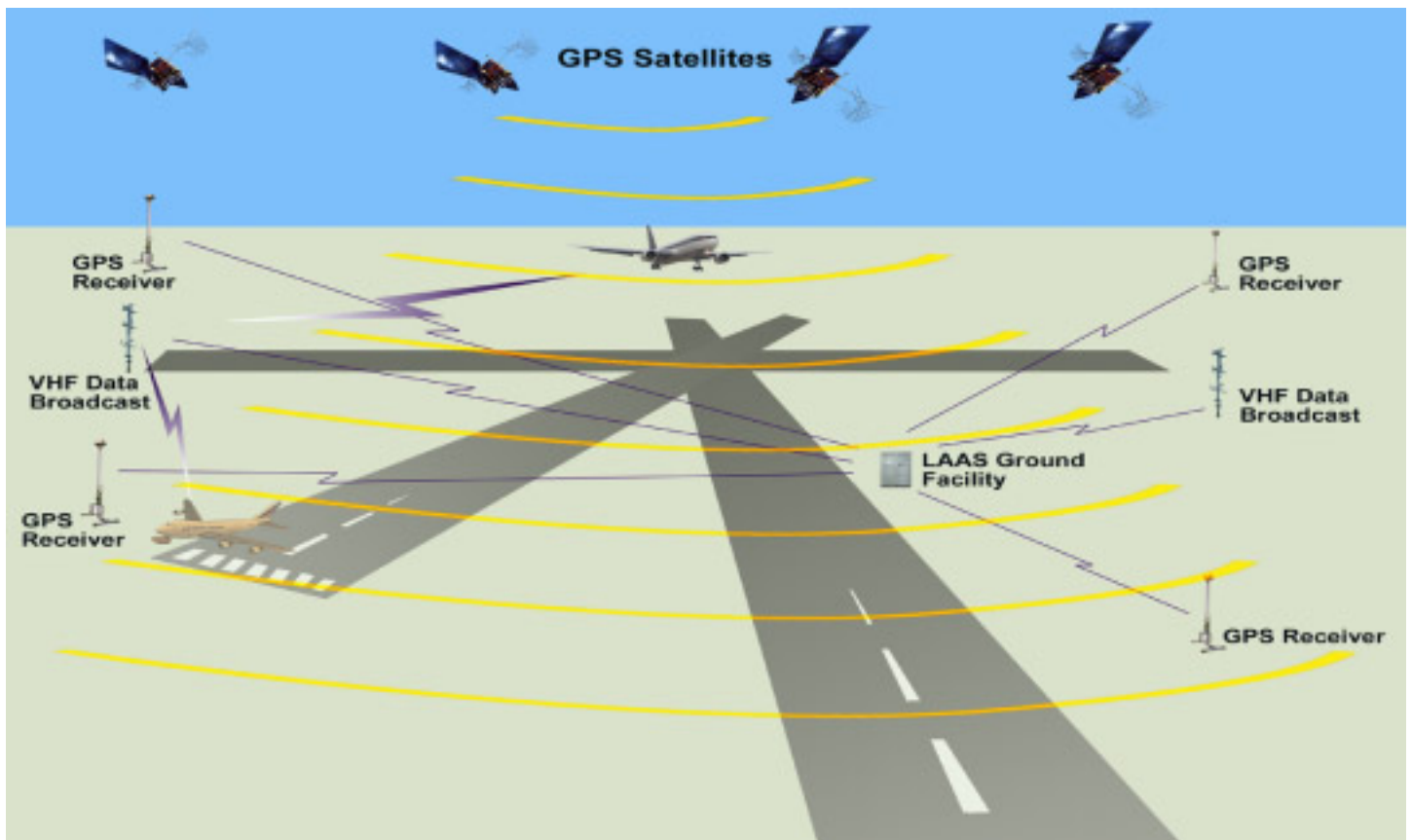
The Local Area Augmentation System (LAAS) has a LAAS ground facility (LGF) that is installed at the airport where LAAS service is desired. LAAS service supports precision approach and Area Navigation. The LAAS Service Availability is defined as the probability that LAAS service will be available. Evaluation of service availability requires the evaluation of GPS constellation availability and LGF inherent availability.

Inherent availability (Ai) for a particular equipment is defined by the Mean-Time-Between-Failure (MTBF) and Mean-Time-To-Repair (MTTR). In equation form, Ai = MTBF/(MTBF+MTTR). Thus for a system that has an MTBF of 5000 hours and MTTR of 30 minutes, the inherent availability is 0.9999. Whether this simple formula can be used for complex systems with MTBF of the order of 50,000 hours is still under debate. The LAAS ground facility specification (draft specification, dated August 22, 2001) defines two configurations to accommodate the range of availability requirement from the LAAS requirements document. A standard configuration with 0.9999 of inherent availability is defined and then an upgraded configuration is defined which would be able to achieve 0.99999 of inherent availability with an MTTR of 30 minutes.

An August 2001 study from MITRE indicates that the average GPS constellation availability without including any WAAS GEOs is of the order of 0.9998 at the 176 airports chosen for providing LAAS service. Furthermore, the study states that with four WAAS GEO satellites, in addition to the GPS satellites in the constellation, the average constellation availability increases to 0.9999. This study takes into account the final draft GPS SPS performance specification and other conservative assumptions on the error terms that are characteristic to local LGF locations. This study also includes results for 78 different airports where LAAS CAT II/III service is envisioned. With current CAT II/III requirements described in the RTCA MASPS (DO-245), the average GPS (alone) constellation availability is of the order of 0.9994, while the average availability with four WAAS GEOS turns out to be 0.99997.

As mentioned above, the LAAS service availability at any given airport is a probabilistic combination of the inherent LGF availability and the GPS satellite constellation availability. It turns out that the service availability achieved with existing satellite constellation definition is 0.999 (average over 176 airports) using a standard LGF configuration and 0.9999 (average over 176 airports) with an enhanced version of the LGF.

There are other various availabilities that are associated with LAAS such as true availability, predictive availability, and short-term operational availability. The LAAS program office is in the process of putting together an Availability Working Group that will be tasked to make the definitions of all availabilities consistent. Furthermore, the charter of the Availability Working Group will include defining availability requirements for CAT II/III and quantifying availability enhancement due to WAAS and to pseudolites.

SISAT Update

By Todd Lardy, Flight Test Engineer, Naval Air Systems Command, NAS Implementation Team (AND-720)

An article appeared in the March edition of *SatNav News* describing a tool that analyzes satellite-based augmentation system (SBAS) signals known as the SBAS Signal-In-Space Analysis Tool (SISAT). Since March, several modifications have been made to improve the functionality and utility of this tool. The latest SISAT version (2.3) was released on August 17, 2001 and is being mailed on CD ROM to the 30+ government and industry organizations that are currently using earlier SISAT versions.

Included in version 2.3 are:
· Processing improvements to allow longer data files to be read and processed including conversion from ASCII to binary files and from DOS-based executables to MEX-based libraries
· The addition of a carrier smoothing filter with a user selectable parameter to control the filter time constant
· An interface to allow WAAS data from the National Satellite Test Bed to be downloaded from the FAA Technical Center web-site and analyzed using SISAT
· An interface to decode Novatel receiver data to allow data from the European SBAS analysis tool (Pegasus) to be processed
· Various improvements to the user interface and input and output data formats

For additional information or to obtain a copy of the Signal-In-Space Analysis Tool, contact Bob Beal at (703) 841-2246 or robert.ctr.beal@faa.gov.

We want your feedback. We encourage your questions, suggestions, and recommendations for improvement. Please e-mail our editor at Shelby.ctr.Wheeler@faa.gov.

Federal Aviation Administration
800 Independence Avenue, SW
Washington, DC 20591

http://gps.faa.gov